Mathematical Tools for Neuroscience (NEU 314)
Princeton University, Spring 2016
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Homework 0: matlab warmup

Due: *it's not due*

Here are some warmup problems to help bring you up to speed on using matlab.

Variable assignment and indexing

Start by reading *Matlab for neuroscientists*, Section 2.2.1-2.2.3, and 2.2.5. (A pdf of the chapter is available under "resources" on Piazza). This should take you through the basics of interacting with the matlab command window, basic math operations, variable assignment, matrix creation, and the basic commands `who`, `whos`, `clear`, `linspace` ,the colon operator (:), and the all-important command `help`.

1. Clear the workspace. Create the following matrix in matlab and assign it to the variable `A`:

$$\begin{pmatrix} 1 & 3 \\ 5 & 7 \\ 9 & 11 \end{pmatrix}.$$

   Access the element $i = 2$, $j = 1$, and change it to 33.

2. Create a new matrix `B` that is the transpose of `A`.

3. Create C that has two copies of `A` stacked on top of each other.

4. Extract the second column of `C` and assign it to a variable x.

5. Make a vector `y` that has the squared elements of `x` in it.

6. Create D that has two copies of `A` concatenated side-by-side.

7. Matrix multiply `C`-transpose times `y`.

Clear the workspace.

8. Create a new variable named `A` that contains the integers 1 through 12 arranged in a 4×3 matrix (arranged with integers 1 through 4 in the first column, 5 to 8 in the second column, and 9 to 12 in the last).

   (a) First, do this the "dumb" way by setting the integers in a list separated by "," and ";" symbols.

   (b) Then, do it the "smart" way using the colon operator and `reshape`. (Use "`help reshape`" if you are unfamiliar with `reshape`.)

9. Create a time vector `t` that goes from 0 to 100 in increments of 5. Do this first with the colon operator, then try again using `linspace`.

10. Create a vector `q` whose elements are equal to 3 times the corresponding element of `t` raised to the power of 2.

11. Create a 5×5 matrix of all-1's using `ones`, a 10×5 matrix of all-0's using `zeros`, and a 10×10 identity matrix using `eye`.

Plotting

Read Section 2.3.1 of *Matlab for neuroscientists* on Basic Visualization.

12. Plot a sine wave over the interval $[0, 4\pi]$. First, make a vector `t` that goes from 0 to 4π in 200 even increments. Then make a plot of `sin(t)` vs. `t`. Label your x and y axes using `xlabel` and `ylabel`, and give your plot a title using `title`.

13. Clear the figure window ("`clf`"). Plot the vectors $(3, 1)$ and $(2, 5)$, and $(-2, 3)$ as line segments extending from the origin to vector endpoint, all on the same set of axes.

If you like, please finish reading chapter 2 of *Matlab for neuroscientists*, preferably with a Matlab window open in front of you. The more you front-load on programming basics now, the easier it will be to have matlab serve you (rather than vice versa) when it comes to tackling the math topics!